SUBSTITUTE SPECIFICATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains in general to a system and method for the accurate estimation of the position of and underwater vehicle and more particularly to a system and method for the estimation and tracking of an underwater vehicle's position using a combination of bathymetry data, and the underwater vehicles dynamics data in relation to a position marker.

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2. Description of the Prior Art

Under water vehicles are in common use for surveying and locating objects in the ocean due to their relatively low operation cost. To be useful however, the position of an underwater vehicle must be known so that the data collected by the towed vehicle's sensors can be georectified. Due to ocean dynamics, currents, waves, temperature fluctuation and etc., acting on underwater vehicle's tether or on the vehicle itself, a submerged vehicles position relative to the towing vehicle or some other georectified point is often difficult to determine. Since the ocean is opaque to high-frequency electromagnetic signals, the global positioning system (GPS) generally cannot be used for submerged vehicle positioning.

Current methods for determining the position of a underwater vehicle include the lay-back model (See, FIG. 1), the long base line (LBL) model (See FIG. 2), the short base line (SBL) model (See FIG. 3), the inverted SBL system and the Localization System (LOST)(See FIG. 4). These system are generally configured to manage the position of a tethered or towed vehicle and are ill equipped for an remote or untethered underwater vehicle.

With the lay-back model method the underwater vehicle is tethered and is assumed to be directly behind the towing vehicle and the lay-back (distance from the towing vehicle) is assumed to be a fixed multiple of the tow vehicle's depth. Alternatively, the amount of cable paid out is assumed to be the slant range to the tow vehicle. The inverted SLB method does not take into account the cable's cantilever. The neither the lay-back, the LBL, or the SLB methods take in account the effects of local current on the cables' shape and position. The accuracy of these methods will in general suffer as a function of time and therefore not support precise positioning of the towed vehicle.

The LBL method uses a series of acoustic transponders to localized the tow-vehicle by measuring the time delays between the tow –vehicle and the transponders. These transponders may be bottom mounted or localized on the surface, such as shown in U.S. Patent 5,119,341. While these systems are very accurate, their deployment is a time consuming and expensive operation. Furthermore the LBL method requires that the systems be redeployed to each operational area.